spaced;

maintaining the at least one projector and the pattern of imagable electromagnetic radiation and the detector in a substantially fixed relation to each other;

C1 cont'd.

measuring an amount of radiant energy in the received electromagnetic radiation signal with the detector wherein each of the detector elements produce an image having a different phase of the same scanned surface based on the measurement; and

computing phase values and amplitude values for the different phases from the multiple images.

2. The method as claimed in claim 1 wherein the physical information is dimensional information and the imagable electromagnetic radiation is light.

3. The method as claimed in claim 2 wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially parallel to the optical axis and wherein the projected pattern of light is a stripe of lines.

4. The method as claimed in claim 2 further comprising the step of determining height of the surface of the object based on the phase and amplitude values.

5. The method as claimed in claim 1 wherein the physical information is polarization information, the imagable electromagnetic radiation is polarized, a response of the detector elements is polarization sensitive and wherein the images are based on polarization from the surface.

6. The method as claimed in claim 1 wherein the plurality of detector elements are uniformly spaced and wherein the step of moving is performed uniformly and continuously.

7. The method as claimed in claim 1 wherein the step of computing includes the step of registering the images.

8. The method as claimed in claim 1 wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector and optical axes.

9. The method as claimed in claim 8 wherein the detector is a multi-linear array camera.

10. The method as claimed in claim 8 wherein each detector element is a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

11. The method as claimed in claim 1 wherein the step of projecting is performed with two projectors.

12. The method as claimed in claim 11 wherein the step of moving includes the step of cycling the object relative to the two projectors wherein the two projectors alternately project the pattern of imagable electromagnetic radiation.

13. The method as claimed in claim 11 wherein the two projectors alternately project the pattern of imagable electromagnetic radiation during consecutive scans of the projected pattern of imagable electromagnetic radiation.

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14. [Amended Once] A system for high speed, scanning phase measuring of an object at a vision station to develop physical information associated with the object, the system including:

at least one projector for projecting a pattern of imagable electromagnetic radiation;

means for moving the object relative to the at least one projector at the vision station at a substantially constant velocity so as to scan the projected pattern of imagable electromagnetic radiation across a surface of the object to generate an imagable electromagnetic radiation signal;

a detector for receiving the imagable electromagnetic radiation signal from the surface of

the object and having a plurality of separate detector elements which are substantially uniformly spaced for measuring an amount of radiant energy in the imagable electromagnetic radiation signal wherein each of the detector elements produces an image having a different phase of the same scanned surface based on the measurement;

C2 cont'd

means for maintaining the at least one projector <u>and the pattern of imagable electromagnetic radiation</u> and the detector in a substantially fixed relation to each other; and

means for computing phase values and amplitude values for the different phases from the images.

15. [Amended Once] The system as claimed in claim 14 wherein the physical information is dimensional information and the imagable electromagnetic radiation is light.

16. The system as claimed in claim 15 wherein the detector has an optical component for receiving the reflected light signal, the optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially parallel to the optical axis and wherein the projected pattern of light is a stripe of lines.

17. The system as claimed in claim 15 further comprising means for determining height of the surface of the object based on the phase and amplitude values.

C3 Sub D37

18. [Amended Once] The system as claimed in claim 14 wherein the physical information is polarization information, the imagable electromagnetic radiation is polarized, a response of the detector elements is polarization sensitive and wherein the images are based on polarization from the surface.

19. The system as claimed in claim 14 wherein the plurality of detector elements are uniformly spaced and wherein the means for moving moves the object relative to the at least one projector uniformly and continuously.

20. The system as claimed in claim 14 wherein the means for computing includes means for registering the images.

21. The system as claimed in claim 14 wherein the detector elements are elongated in a direction parallel to a detector axis of the detector and wherein the detector also has an optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially perpendicular to the detector and optical axes.

22. The system as claimed in claim 21 wherein the detector is a multi-linear array camera.

23. The system as claimed in claim 21 wherein each detector element is a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the means for moving moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

24. The system as claimed in claim 14 further comprising two projectors, the two projectors projecting the pattern of imagable electromagnetic radiation.

25. The system as claimed in claim 24 wherein the means for moving cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of imagable electromagnetic radiation during consecutive cycles.

Sub D4

26. [Amended Once] The system as claimed in claim 24 wherein the two projectors alternately project the pattern of electromagnetic radiation during consecutive scans of the projected pattern of imagable electromagnetic radiation.

27. The system as claimed in claim 14 wherein the at least one projector and the detector at least partially define an optical head.

28. The method as claimed in claim 2 wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light is a stripe of lines.

29. The system as claimed in claim 15 wherein the detector has an optical component for receiving the reflected light signal, the optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light is a stripe of lines.

Sub D5

30. [Amended Once] A method for high-speed scanning measurement of an object at a vision station, the vision station having a detector, in order to determine dimensional information associated with the object, the method comprising the steps of:

projecting a pattern of light;

maintaining the projected pattern of light and the detector in a substantially fixed relation to each other;

C5

moving the object relative to the projected pattern of light so as to scan the projected pattern of light across an area of a surface of the object to generate an imagable light signal;

imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at a first phase of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at a second phase of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light;

measuring with the detector an amount of light from the area of the surface of the object to the first detector element at the first phase, to the second detector element at the second phase, and to the third detector element at the third phase; and

computing dimensional information based on the measuring step.

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31. The method according to claim 30, wherein each one of the first, second, and third detector element includes a plurality of detector pixel elements.

32. The method according to claim 30, wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

33. [Amended Twice] The method according to claim 30, wherein the measurement step obtains an amplitude value at each one of the three phases, and further comprising the step of determining a height of the area of the surface of the object based on phase and amplitude values from the measuring step.

34. The method according to claim 30, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

35. The method according to claim 30, wherein the step of computing includes the step of registering the images.

36. The method according to claim 30, wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

37. The method according to claim 36, wherein the detector includes a tri-linear array camera.

38. The method according to claim 30, wherein each detector element includes a row of CCD

sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

C7

39. [Amended Once] The method according to claim 30, wherein the step of projecting includes the step of projecting with two projected patterns of light.

40. The method according to claim 39, wherein the step of moving includes the step of cycling the object relative to the two projected patterns of light, and wherein the two projected patterns of light are alternately projected.

41. The method according to claim 39, wherein the two projected patterns of light are alternately projected during consecutive scans.

C8

42. [Amended Once] A system for high-speed scanning measurement of an object at a vision station in order to determine dimensional information associated with the object, the system including:

a first projector that projects a pattern of light, the pattern of light having a first, a second, and a third phase;

a drive that moves the object relative to the first projector at the vision station so as to scan the projected pattern of light across an area of a surface of the object to generate an object light signal;

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the object light signal from the area of the scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first phase of the projected pattern of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second phase, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third phase, and wherein the

C8 concld.

detector is maintained in a substantially fixed relation to the first projector and to the pattern of light; and

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

43. The system according to claim 42, wherein each detector element includes a plurality of detector pixels elements.

44. The system according to claim 42, wherein the detector has an optical element for receiving the object light signal, the optical element having an optical axis, and wherein the drive moves the object relative to the first projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

C9

45. [Amended Once] The system according to claim 42, wherein the computational element computes a height of the area of the surface of the object based on the first, second, and third image values.

46. The system according to claim 42, wherein the pattern of light is polarized and a response of the detector elements is polarization sensitive.

47. The system according to claim 42, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

48. The system according to claim 42, wherein the computational element registers the images.

49. The system according to claim 42, wherein:

the detector elements are elongated in a direction parallel to a detector axis of the detector;

the detector also has an optical element having an optical axis; and

the drive moves the object relative to the first projector in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

50. The system according to claim 49, wherein the detector includes a tri-linear array camera.

51. The system according to claim 42, wherein:

each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis, and

the drive moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

52. The system according to claim 42, further comprising a second projector, the first and second projectors projecting the pattern of light.

53. The system according to claim 52, wherein the drive cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of light during consecutive cycles.

54. The system according to claim 52, wherein the two projectors alternately project the pattern of light during consecutive scans of the projected pattern of light.

55. The system according to claim 42, wherein the projector and the detector define at least part of an optical head.

56. [Amended Once] A system for high-speed scanning height measurement of an object at a vision station in order to determine dimensional information associated with the object, the

system comprising:

an optical head, the optical head including:

a projector that projects a pattern of light, the projected pattern of light varying in intensity as a function of position and having a first, a second, and a third intensity; and

C 10 cont'd.

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the imagable light signal from [the] <u>an area of a</u> scanned surface of the object, wherein the first detector element produces a first image value based on an image of <u>the area of</u> the scanned surface at the first intensity of the projected pattern of light, the second detector element produces a second image value based on an image of <u>the area of</u> the scanned surface at the second intensity, and the third detector element produces a third image value based on an image of <u>the area of</u> the scanned surface at the third intensity, and wherein the detector is maintained in a substantially fixed relation to the projected pattern of light.

57. [Amended Once] The system according to claim 56, further comprising

a drive that moves the object relative to the projector at the vision station so as to scan the projected pattern of light across a surface of the object to generate an imagable light signal.

58. The system according to claim 56, further comprising

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

59. The system according to claim 56, wherein the detector includes a tri-linear array.

Sub D17 C 10

60. [Amended Once] A method for high-speed scanning measurement of an object at a vision station, the vision station having a detector, in order to determine dimensional information associated with the object, the method comprising the steps of:

projecting a pattern of light, the projected pattern of light having a first, a second, and a third intensity at first, a second, and a third position, respectively;

maintaining the projected pattern of light and the detector in a substantially fixed relation to each other;

moving the object relative to the projected pattern of light so as to scan the projected pattern of light across a surface of the object to generate an imagable light signal;

C1 concl'd.

imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at the first intensity of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at the second intensity of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at the third intensity of the projected pattern of light;

measuring with the detector an amount of light from the area of the surface of the object to the first detector element at the first intensity, to the second detector element at the second intensity, and to the third detector element at the third intensity; and

computing dimensional information based on the measuring step.

61. The method according to claim 60, wherein each one of the first, second, and third detector element includes a plurality of detector pixel elements.

62. The method according to claim 60, wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

Sub D19 C12

63. [Amended Once] The method according to claim 60, further comprising the step of determining a height of the area of the surface of the object based on phase and amplitude values from the measuring step.

64. The method according to claim 60, wherein a spacing between the first and second

detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

65. The method according to claim 60, wherein the step of computing includes the step of registering the images.

66. The method according to claim 60, wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

67. The method according to claim 66, wherein the detector includes a tri-linear array camera.

68. The method according to claim 60, wherein each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

69. [Amended Once] The method according to claim 60, wherein the step of projecting includes the step of projecting with two projected patterns of light.

70. The method according to claim 69, wherein the step of moving includes the step of cycling the object relative to the two projected patterns of light, and wherein the two projected patterns of light are alternately projected.

71. The method according to claim 69, wherein the two projected patterns of light are alternately projected during consecutive scans.

AmD237

72. [Amended Once] A system for high-speed scanning measurement of an object at a vision station in order to determine dimensional information associated with the object, the system including:

a first projector that projects a pattern of light, the pattern of light having a first, a second, and a third intensity;

a drive that moves the object relative to the first projector at the vision station so as to scan the projected pattern of light across an area of a surface of the object to generate an object light signal;

C 13

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the object light signal from the area of the scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first intensity of the projected pattern of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second intensity, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third intensity, and wherein the detector is maintained in a substantially fixed relation to the first projector and the pattern of light; and

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

73. The system according to claim 72, wherein each detector element includes a plurality of detector pixel elements.

74. The system according to claim 72, wherein the detector has an optical element for receiving the object light signal, the optical element having an optical axis, and wherein the drive moves the object relative to the first projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

C 15

75. [Amended Once] The system according to claim 72, wherein the computational element

AmD25

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computes a height of <u>the area of</u> the surface of the object based on the first, second, and third image values.

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76. The system according to claim 72, wherein the pattern of light is polarized and a response of the detector elements is polarization sensitive.

77. The system according to claim 72, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

78. The system according to claim 72, wherein the computational element registers the images.

79. The system according to claim 72, wherein:

the detector elements are elongated in a direction parallel to a detector axis of the detector;

the detector also has an optical element having an optical axis; and

the drive moves the object relative to the first projector in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

80. The system according to claim 79, wherein the detector includes a tri-linear array camera.

81. The system according to claim 77, wherein:

each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis, and

the drive moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

82. The system according to claim 72, further comprising a second projector, a second projector, the first and second projectors projecting the pattern of light.

83. The system according to claim 82, wherein the drive cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of light during consecutive cycles.

84. The system according to claim 82, wherein the two projectors alternately project the pattern of light during consecutive scans of the projected pattern of light.

85. The system according to claim 72, wherein the projector and the detector define at least part of an optical head.